DICOM
Second Generation Radiotherapy
Supplement 175
C-Arm RT Treatment Modalities

DICOM Working Group 07
Radiotherapy
Rationale

Shortcomings of current Radiotherapy Objects
‘RT 1st Generation’

Radiotherapy Workflow Representation:
• Basically all function points in one IOD: RT Plan (beside Treatment Records)
• No independent IOD for Prescription
• Not suited for adaptive character of today’s radiation therapy processes (1st Generation originated from a model of one-time planning, which is outdated today)
  -> Hard to use 1st Generation IODs in a dynamic workflow environment

Conclusions:
• New set of IODs is needed
• Partitioned along the different function points of the workflow
• Each object has its dedicated role
• Extensible for new treatment techniques, positioning technologies, etc.
Rationale

Shortcomings of RT Plan IOD

Over-extended Scope

• Treatment parameter definition for treatment delivery: OK
• Besides delivery, various other workflow elements are represented in the same object (prescription, positioning etc.)
• Prescription: only basic information and scope of data not defined
• Positioning: just basic information, no extensibility
  No way to cover new technologies (unless extending the RT Plan even further)

Not Extensible for new Treatment Technologies

• Unbalanced, historically grown structure:
  • Photon / Electron Beam and Brachytherapy together in one IOD
  • Ion Therapy as separate IOD
  • Three Treatment Record IODs for two plan IODs
• No concept how to represent new treatment delivery devices
Main Object of a Radiotherapy Treatment Fraction

- Container of all contributions of therapeutic radiation dose
- Represents the therapeutic radiation dose
  - In a generic way
  - Uses Conceptual Volumes as dose tracking entities
  - Concept of physical and radiobiological dose addressed

Independent of Treatment Device and Treatment Technique

- References RT Radiation IODs of any device
- New RT Radiation IODs can be integrated seamlessly
Overview

RT Treatment Fraction Level
(Preference-independent)

Modalities of Sup 175
- C-Arm Photon RT Radiation IOD
- Tomotherapeutic RT Radiation IOD
- Robotic RT Radiation IOD
- Ion RT Radiation IOD
- Brachy Therapy RT Radiation IOD

Modalities of Sup 176
- C-Arm Electron RT Radiation IOD
- Multi Fixed Source RT Radiation IOD
- New ABC RT Radiation IOD
- New DEF RT Radiation IOD

Future IODs for known Techniques

More Future IODs, any time as needed
Radiation IOD

Technique-independent Modules
• Serve as container of all Radiation IODs which constitute a radiotherapy treatment fraction
• Represent the therapeutic radiation dose
  • Generically (although concept of physical and radiobiological dose are addressed)

Technique-specific Modules
• Accommodate specific treatment parameters
• Use of generic building blocks as needed by the specific technique
Control Points
- Proven concept kept in place
- Optimized value change representation

Energy and Radiation Type
- Rich model, including Beam Generation Modes ("FFF", etc.)
- Re-usable representation

Device-Components, Beam Modifiers
Re-usable build blocks (Macros) for:
- Beam Limiting Devices (Collimators, MLCs)
- Applicators
- Compensators
- Blocks
- Wedges
- Others in future as needed

Generic scheme for identification and classification
- High re-use of ‘header data’
Generalized Geometric Information

- IEC 61217 coordinate system where applicable
- Other coordinate systems possible as well
- Always based on Frame Of Reference Formalism
  - Generic registration of Patient FOR to Device FOR
  - Transformation instead of specific Patient Positioner Parameters
  - Specific Patient Positioner Parameters as annotation available, too

Reduced Optionality

- Essential Information mandatory (Type 1)
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